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FURTHER ADVANCES IN THE TAXONOMY AND  
DISTRIBUTION OF THE GRYLLOBLATTIDAE  
(ORTHOPTERA)

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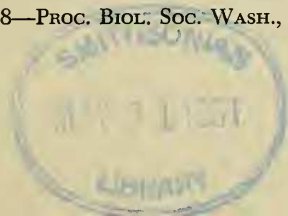
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In this paper the important developments in the study of the Grylloblattidae since 1953 are summarized. As in my 1953 report and my two earlier ones, new species are described, and recent papers of other authors are cited, with annotations included for some of them.

In addition to the material reported here, some other species have been made available to J. W. Kamp of Redding, Calif., who has a longtime interest in the group, and from whom a valuable contribution may be expected. He was one of the first entomologists to find grylloblattids in caves, a habitat which since has been worked very successfully by several collectors.

Since 1924, when Caudell and King described the first Japanese grylloblattid, it has been apparent that the group once must have had a faunal connection by a Bering Sea land bridge. The notable discovery in 1959, by Robin E. Leech and E. R. MacDougall, of *Grylloblatta* in northern British Columbia, whets the hope that some day a species will be found in Alaska. As recently as 1951, a new genus was described from Siberia by Bei-Bienko, so the tie-in between the Asiatic and American faunas has become much closer than it was 10 years ago. Papers by Griffin (1960) and Simpson (1947) give helpful background on Siberian-Alaskan land connections.

It has become increasingly evident that male genitalia are important in distinguishing species, and that, when more localities and habitats have been examined, many species may



be found. Here I have adopted mainly Walker's (1956) terminology for the male genitalia. Thus, "coxopodite" is used in place of the "coxite" of my 1953 paper, "first accessory copulatory process" in place of "accessory sclerite of right phallosome," and "principal copulatory sclerite" instead of "main phallic sclerite." In lieu of the last-named, Walker used "process" instead of "sclerite," but I prefer "sclerite" for the sclerotized structure, with "process" for the pointed apical portion.

As with my earlier papers, the interest and cooperation of numerous individuals enable me to report on significant discoveries made by them by virtue of hard work in the field. I am deeply indebted for the sustained help of the following persons, as well as for the privilege of retaining specimens for the National Museum: Thomas C. Barr, Jr., Tennessee Polytechnic Institute, Cookeville; M. Chûjô, Kagawa University, Takamatsu-shi, Japan; David G. Fellin, John D. Lattin, and H. A. Scullen, Oregon State College, Corvallis; W. J. Gertsch, American Museum of Natural History, New York, New York; Wm. R. Halliday, Seattle, Washington; George P. Holland and John E. H. Martin, Canadian Department of Agriculture, Ottawa; K. Morimoto and K. Yasumatsu, Kyushu University, Fukuoka City, Japan; Harry Reese and his family, Ariel, Washington; Vincent D. Roth, El Centro, California; E. M. Walker, Toronto, Canada.

GRYLLOBLATTA Walker

*Grylloblatta washoa*, new species

(Figs. 10-17)

*Male* (holotype): Size medium for genus; minutely pubescent; major body setae inconspicuous; antennae with 28 segments (left), 23 (right, broken); compound eye (Fig. 10) about as in *rothi*; pronotum with greatest width nearly as much as length (see measurements), proportionately less elongate than in *rothi*; leg ratios (length divided by width) as follows: front femur, 3.2; hind femur, 4.6; front tibia, 5.5; hind tibia, 9.4.

Supra-anal plate (Fig. 12) with posterior margin weakly asymmetrical, less so than in *rothi*, anterior margin strongly asymmetrical; left coxopodite about as in *rothi*, but left stylus borne basally (Fig. 15); right coxopodite lacking strong lateral setae, and with stylus short and borne basally (Fig. 16); principal copulatory sclerite differing from *rothi* in that apex of copulatory process (Fig. 13, *e*) is less elongate and the lateral margin is less protruding; apical process of first accessory copu-

latory process (Fig. 11) more sharply constricted at base than in *rothi*, and the apex nearly truncate; hooklike apical process of second accessory copulatory process (Fig. 14) much as in *rothi* (Fig. 9); cerci (Fig. 17) with few major setae (others broken?), segments in apical half proportionately more elongate than in *rothi*.

*Coloration*: General coloration pale straw, major leg spurs somewhat darker; thoracic nota, antennae and cerci very pale; segments of latter whitish basally and apically as shown by dotted areas in Fig. 17; eyes black.

*Measurements* (length in millimeters): Body, about 22; antenna, about 9; eye, 0.6; pronotum, 2.3; hind femur, 3.2; hind tibia, 3.3; cercus, 4.0; width of head, 2.4; of pronotum, 2.2; of hind femur, 0.7.

*Type*: American Museum of Natural History. A male from Echo Summit, 7,382 ft altitude, 4 miles south of Meyers, Eldorado County, California. Collected 9 September 1959, by Willis J. Gertsch and Vincent D. Roth. Echo Summit, a high point on Highway 50, is near Echo Peak, which is about one mile directly north of Upper Echo Lake.

Three nymphs, ranging in length from 4 to 8 mm, were collected with the type. Mr. Roth has written me that the specimens were "dug out from a shaded three-foot-diameter rotten log which was buried one-third by soil, leaf mold, and bark. The specimens were in the lower one-third in a very damp, cold and dark habitat. The location was no more than 100 feet from the paved highway."

In my 1953 key to the species of *Grylloblatta*, *washoa* runs to *bifratrilecta*, from which it differs in being smaller, with the cerci shorter as a whole as well as with respect to individual segments. The styli of *washoa* also are shorter. The supra-anal plate of *bifratrilecta* is similar but differs in details, as the original 1953 figures show. The cerci and general habitus of *washoa* suggest close relationship to *rothi*, but the latter differs in the laterally attached styli, in the shape of the supra-anal plate, and in the proportionally shorter segments in the apical half of the cercus.

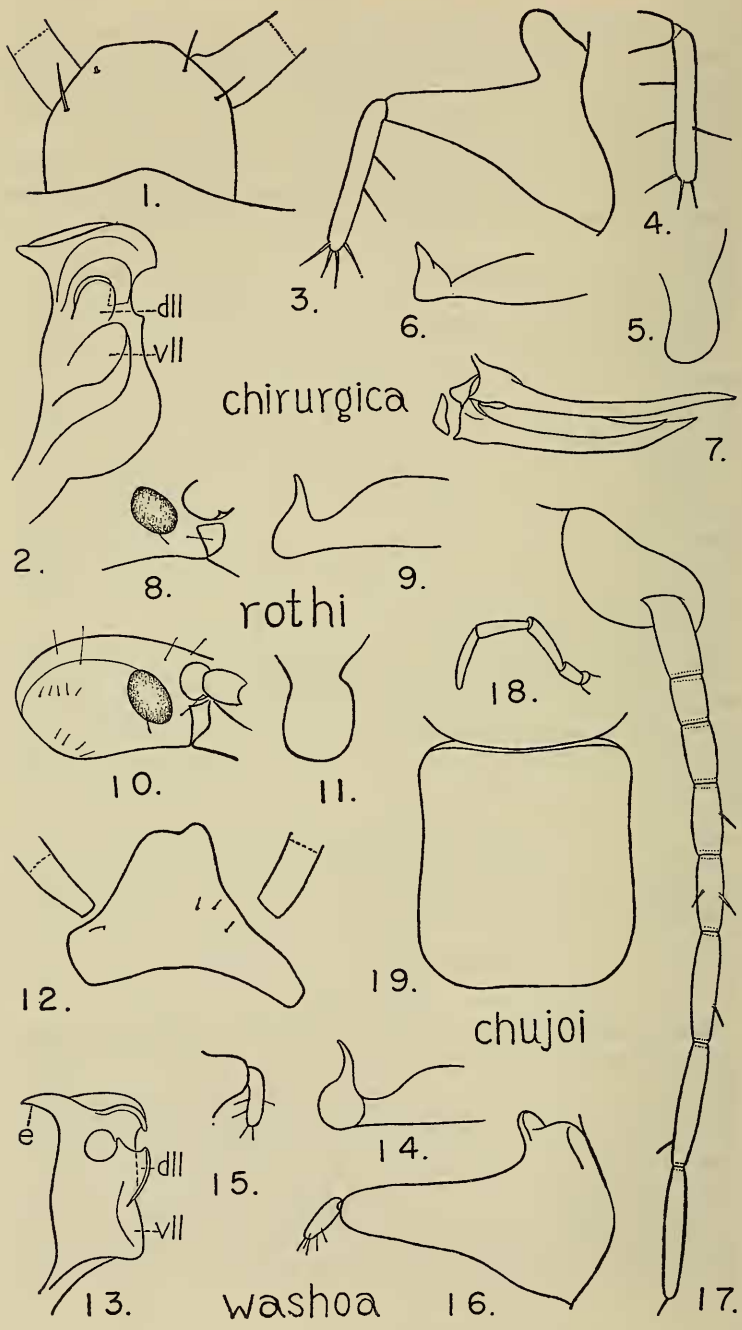
The specific name refers to the Washo people, a small Indian tribe which occupied the upper drainage of the Truckee and Carson Rivers, including the area around Echo Peak.

### *Grylloblatta chirurgica*, new species

(Figs. 1-7)

*Male* (holotype): Size medium for genus; fine body pubescence moderately conspicuous; major setae well developed; antennae with 29 segments (left), 28 (right, broken); compound eye barely smaller than in *washoa* (as 15 to 17) in greatest length, but much smaller in proportion to head size; pronotum with greatest width one-third of length behind anterior margin; leg ratios (length divided by width) as follows: front femur, 3.5; hind femur, 5.5; front tibia, 6.4; hind tibia, 10.4.

Supra-anal plate (Fig. 1) nearly symmetrical, except at base (normally concealed) which is much extended on left side; left coxopodite with only gently curved mesal margin, with stylus borne basally (Fig. 4);



right coxopodite with numerous pale weak setae and several somewhat stronger setae, scarcely any as strong or heavily pigmented as the weakest major seta of stylus, latter borne basally (Fig. 3); principal copulatory sclerite (Fig. 2) with copulatory process relatively short, dorsolateral and ventrolateral lobes (*dll*, *vll*) extending laterally from main body of sclerite; apical process of first accessory copulatory process (Fig. 5) narrower than in *washoa*; hooklike apical process of second accessory copulatory process (Fig. 6) with terminal hook shorter than in *washoa*.

*Coloration*: General coloration yellow straw, major setae and leg spurs darker; thoracic nota darker than abdomen; head light brown, antennae pale; eyes black.

*Measurements* (length in millimeters): Body, about 17; antenna, about 15; eye, 0.5; pronotum, 3.3; hind femur, 5.0; hind tibia, 3.2; cercus, 7.2; width of head, 3.3; of pronotum, 2.9; of hind femur, 0.9; of hind tibia, 0.5.

*Female* (allotype): Differing from male in the usual sexual features. Both antennae with 34 segments; leg ratios (length divided by width) as follows: front femur, 3.5; hind femur, 5.5; front tibia, 6.6; hind tibia, 11.2. Ovipositor (Fig. 7) with dorsal valve reaching to apex of segment 5 of cercus, apical fourth of ovipositor with moderate dorsal curvature.

*Measurements* (length in millimeters): Body, about 18; antenna, about 15; eye, 0.5; pronotum, 3.5; hind femur, 3.9; hind tibia, 5.6; cercus, 6.5; width of head, 3.5; of pronotum, 3.1; of hind femur, 0.9; of hind tibia, 0.5.

*Type*: U. S. National Museum No. 65377. Ape Cave, Skamania County, Washington, 22 and 28 November 1959, Harry Reese and family.

The allotype and 2 female paratypes were taken at type locality, in the lower part of the cave, where conditions were very wet, with a running stream and constant dripping from the ceiling. Specimens apparently

Figs. 1-7. *Grylloblatta chirurgica*. Fig. 1.—Dorsal view of supra-anal plate, holotype. Fig. 2.—Lateral view of principal copulatory sclerite, holotype. Fig. 3.—Right coxopodite and stylus, holotype. Fig. 4.—Left stylus, holotype. Fig. 5.—Apical process of first accessory copulatory sclerite, holotype. Fig. 6.—Apical portion of second accessory copulatory sclerite, holotype. Fig. 7.—Ovipositor, allotype.

Figs. 8-9. *G. rothi*. Fig. 8.—Compound eye and associated structures, holotype. Fig. 9.—Apical portion of second accessory copulatory sclerite, holotype.

Figs. 10-17. *G. washoa*, all from holotype. Fig. 10.—Lateral view of head capsule. Fig. 11.—Apical process of first accessory copulatory sclerite. Fig. 12.—Dorsal view of supra-anal plate. Fig. 13.—Lateral view of principal copulatory sclerite. Fig. 14.—Apical portion of second accessory copulatory sclerite. Fig. 15.—Left stylus. Fig. 16.—Right coxopodite and stylus. Fig. 17.—Left cercus.

Figs. 18-19. *Galloisiana chujoi*, all from holotype. Fig. 18.—Left maxillary palpus. Fig. 19.—Pronotum and posterior margin of head. (Parts of principal copulatory sclerite: *dll*—dorsolateral lobe; *e*—apex; *vll*—ventrolateral lobe.) (Drawings by the author.)



were active, as one escaped. Ape Cave, near Cougar, Washington, and more than 2 miles long, is said by Halliday (1959: 38) to be the largest individual lava tube in the United States.

A third female paratype was taken in moss in the twilight zone of Lake Cave, Skamania County, Washington (Sec. 8, T 7N, R 5E), elevation 1,900 ft, 28 December 1958 (W. R. Halliday, collector). In 1958 Halliday found 2 small nymphs, which may be this species, in Nielsen's Cave, which is in Skamania County about 1,000 ft southeast of Big Cave, about 2 miles south of the intersection of a road extending west from Trout Lake and one running south to Willard.

Two of the paratypes have the ovipositor reaching across the basal third of segment 6 of the cercus. There are only 3 unbroken antennae among the paratypes, 2 of them with 34 segments, the other with 33 segments. Size and proportions do not appear to vary significantly from the allotype.

The specific name is adapted from two Latin words, meaning "pertaining to the surgeon," with reference to the great assistance contributed by W. R. Halliday in obtaining specimens. For an introduction to western caves, readers are referred to his recent book (Halliday, 1959).

#### *Grylloblatta sculleni* Gurney

Two adult females of *sculleni* taken in the Three Sisters area of Oregon on 1 August 1959, have been examined. One was taken by H. A. Scullen at Scott Camp, the type locality, elevation 6,600 ft. The right and left antennae have 35 and 39 segments, respectively. The other was found by H. H. Crowell at nearby Sunshine Meadow, elevation 6,600 ft. One antenna has 38 segments; the other apparently is broken. Both of the specimens are pale amber, much lighter than the holotype.

A single nymph about 6 mm long, with the following data, has been examined: Oregon, Linn County, Quartzville Creek, one-half mile east of Green Creek (Sec. 26, T 11S, R 4E), elevation 1,900 ft, 14 November 1959, on ground under piece of bark in western hemlock-Douglas fir forest, frost on ground (H. A. Hacker, collector). The nymph cannot be identified, and may be either *sculleni* or *rothi*. Both species are known only from altitudes above 6,000 ft, so this new locality for the genus at a decidedly low elevation is of much interest.

#### *Grylloblatta campodeiformis campodeiformis* Walker

In 1953 I summarized the Montana records, and Chapman (1953) contributed ecological notes on observations made at several localities in western Montana. Several new records from the vicinity of Missoula and many ecological notes have recently been assembled by David G. Fellin, whose material has been sent to me for examination. Henson has published (1957a, 1957b) results of his studies in Alberta.

A very significant collection questionably identified as *G. campodeiformis campodeiformis* from Summit Lake, British Columbia, on the Alaska Highway, 392 miles from Dawson Creek, was made in 1959 through the diligent efforts of Robin E. Leech. In the absence of an

adult male, confirmation of the identification is lacking. Leech collected 23 nymphs ranging from 8 to 15 mm long on 16 June under stones at the snow line, at 4,700 ft elevation; 3 adult females on 20 June on the east slope of Mt. St. Paul; and one adult female on 21 June at 5,400 ft elevation. E. E. MacDougall collected 2 adult females on 19 June.

Several structures of the Summit Lake species appear to have slightly different proportions from Montana examples of *campodeiformis*. Many measurements have been made, and the front and hind femora average more slender in the northern population. However, it is not entirely certain that the Summit Lake species warrants a different name. That is particularly true because very little material from the Banff area of Alberta, type locality for *campodeiformis*, has been available to me for comparison. A male from Summit Lake might clarify the situation quickly.

Summit Lake is in northern British Columbia about 450 miles northwest of the Jasper Park area of Alberta, previously the most northern locality for *Grylloblatta*. Interruptions in the main mountain ranges between those two areas suggest that isolation may have been a factor in speciation, if subsequent material demonstrates the existence of distinct entities.

*Grylloblatta* sp.

What may prove to be a new species occurs about 8 miles west of Wallace, Shoshone County, Idaho. Material collected by David G. Fellin includes one adult female and two small nymphs taken 21 November 1959, and two female nymphs each about 15 mm long, collected 21 December 1959. This is the first record of the family in Idaho. The specimens were all found under rocks in the Coeur d'Alene National Forest at a point about one mile northwest of Polaris Peak, and near where the West Fork of Big Creek joins Big Creek.

The body length of the female is about 18 mm, each antenna has 38 segments, and the ovipositor reaches to the middle of the 4th cercal segment. The apical third of the ovipositor shows significant dorsal curvature, whereas that of *campodeiformis* is nearly straight. The species runs near *sculleni* and *barberi* in my 1953 key, and males are needed for best comparisons of these species. Although the two female nymphs are the same size, it is interesting that one has 37 and 38 segments in right and left antennae, respectively, whereas the other has 29 and 28. The latter specimen may be an earlier instar, in spite of size similarity and almost no difference in ovipositor development. The alimentary tract of one of the nymphs taken 21 November measuring 5 mm in length, contains tiny fragments of arthropod sclerites.

***Galloisiana chujoi*, new species**

(Figs. 18-19)

*Female* (holotype): Size medium to large for genus; fine body pubescence and major setae conspicuous; antennae with 43 segments (left), 36 (right, broken), third segment slightly over twice length of second

(as 18 to 7, left; 18 to 8, right); penultimate (4th) segment of maxillary palpus subequal to length of 3rd, as measured along ventral margin (Fig. 18); compound eye absent, with no trace of facets or dark pigmentation, but with slightly paler sclerotization in vicinity of the more dorsal of 2 genal setae corresponding to ocular setae of *nipponensis*, suggesting rudimentary internal light-sensitive organ; pronotum with posterior lateral angles well-rounded, greatest posterior width slightly more than greatest anterior width (as 35 to 34) (Fig. 19); legs more elongate than in type of *nipponensis* (see below).

Abdomen similar to *nipponensis*; cercus with segments comparable to *nipponensis* in slenderness, comparative lengths of the 8 segments as 41, 27, 37, 42, 47, 50, 50, 45; ovipositor with apex of dorsal valve extending to a point across basal one-fourth of segment 4 of cercus.

*Coloration*: General coloration yellow-amber; head and pronotum noticeably darker; setae pale brown.

*Type*: U. S. National Museum No. 65378. Female from Oninowaya Cave, Megi-shima, Kagawa Prefecture, Japan, collected 2 April 1957, by T. Fujisawa. Megi-shima, about 34° 25' N Lat., is a small island about 8 miles from the nearest point on Honshu, and about 2.5 miles north of the city of Takamatsu, which in turn is on the north coast of the middle Japanese island of Shikoku.

The type is the only specimen I have examined. It was briefly described, but not named, by Chûjô (1958). Kawasawa (1950) reported, but did not name, a male grylloblattid collected 6 August 1949, crawling beneath a damp stone about 50 meters from the entrance inside Rakan Cave, Ehime Prefecture, a few miles south of Yusahara, in southwestern Shikoku. The cave is in a limestone formation. Through the cooperation of Chûjô, I have learned that this male is preserved in the Entomological Laboratory of Kyushu University, and Morimoto of that Laboratory has furnished detailed drawings of the specimen. These drawings show that the specimen is immature, probably in the instar immediately preceding maturity, and I cannot identify it to species. Chûjô has written me of finding nymphs beneath pieces of limestone on Mt. Tsurugi, Tokushima Prefecture, Shikoku, though he pointed out the difficulty of finding specimens.

The species which evidently is most closely related to *chujoi* is *Galloistana notabilis* (Silvestri), based on a male nymph, without eyes, taken under a stone at Michino-o, a village near Nagasaki, Kyushu. The latter is the southernmost major island of Japan, and the type locality is some 275 miles from Megi-shima. Because of the immaturity of *notabilis*, a satisfactory comparison cannot be made, but Silvestri's figures show the 4th segment of the maxillary palpus decidedly shorter than the 3rd segment, and the 3rd antennal segment less than twice the length of the 2nd antennal segment. The discovery of topotypic adults of *notabilis* and their description to provide fuller information on the characters of that species are critically needed.

*Galloistana nipponensis* (Caudell and King), of Honshu, has small but



distinct compound eyes, and the ovipositor extends to about the middle of the 3rd cercal segment, thus being proportionally shorter in comparison to the cercus than the ovipositor of *chujoi*. The legs of *nipponensis* appear more robust than those of *chujoi*, as demonstrated by the following ratios of length divided by maximum width, measured from holotypes of the two species: Front femur, *nipponensis* 2.13, *chujoi* 2.9; hind femur, *nipponensis* 2.46, *chujoi* 4.4; front tibia, *nipponensis* 4.16, *chujoi* 6.4; hind tibia, *nipponensis* 6.83, *chujoi* 10.0.

Two species of *Galloisiana*, recently described from the mountains of Honshu by Asahina (1959), are compared with *chujoi* on the basis of their descriptions. *G. yuasai* is described as a smaller species with only 31 to 35 antennal segments. The eyes, though usually well-pigmented, are said to be sometimes quite absent. Asahina shows that the pronotum of *G. kiyosawai* is as broad as long, and the 3rd antennal segment is 3.5 to 4 times as long as the second segment. He also refers to topotypes of *nipponensis*, and it is hoped that future studies will analyze the limits of variation in the various Japanese species.

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